MANAGEMENT OF BYPRODUCT SOLIDS GENERATED IN THE PULP AND PAPER INDUSTRY

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Presentation Coverage

- **Brief introduction to the U. S. pulp and paper industry**
- **Review of the generation, characteristics, and management of byproduct solids**
- **Presentation of two brief case studies**
- **Discussion limited to**
  - **Wastewater treatment plant (WWTP) residuals (“sludge”)**
  - **Boiler ash**

U.S. Pulp and Paper Industry

Pulp & paper mills

- **National annual production: 100 million tons of paper, paperboard, and market pulp**
- **Top 10 states (yr 2000):**
  GA AL LA WA WI MI SC ME OR VA
- **Variety of manufacturing processes, mill capacities, and end products**

Byproduct Generation

- **Annual generation of solid wastes or byproduct solids:**
  15 million dry tons

- **Including**
  - **Wastewater treatment plant (WWTP) residuals**
  - **Boiler ash (also flue gas desulfurization material)**
  - **Causticizing residues**
  - **Wood yard debris**
  - **Pulping and papermaking rejects**

WWTP Residuals

- **5.5 million dry tons annually**
- **Types**
  - **Primary (including deinking residuals)**
  - **Secondary (waste activated sludge)**
  - **Combined primary and secondary**
  - **Dredged**
- **Mechanical dewatering is the norm, with solids content typically 30-40%, range 20-60%**

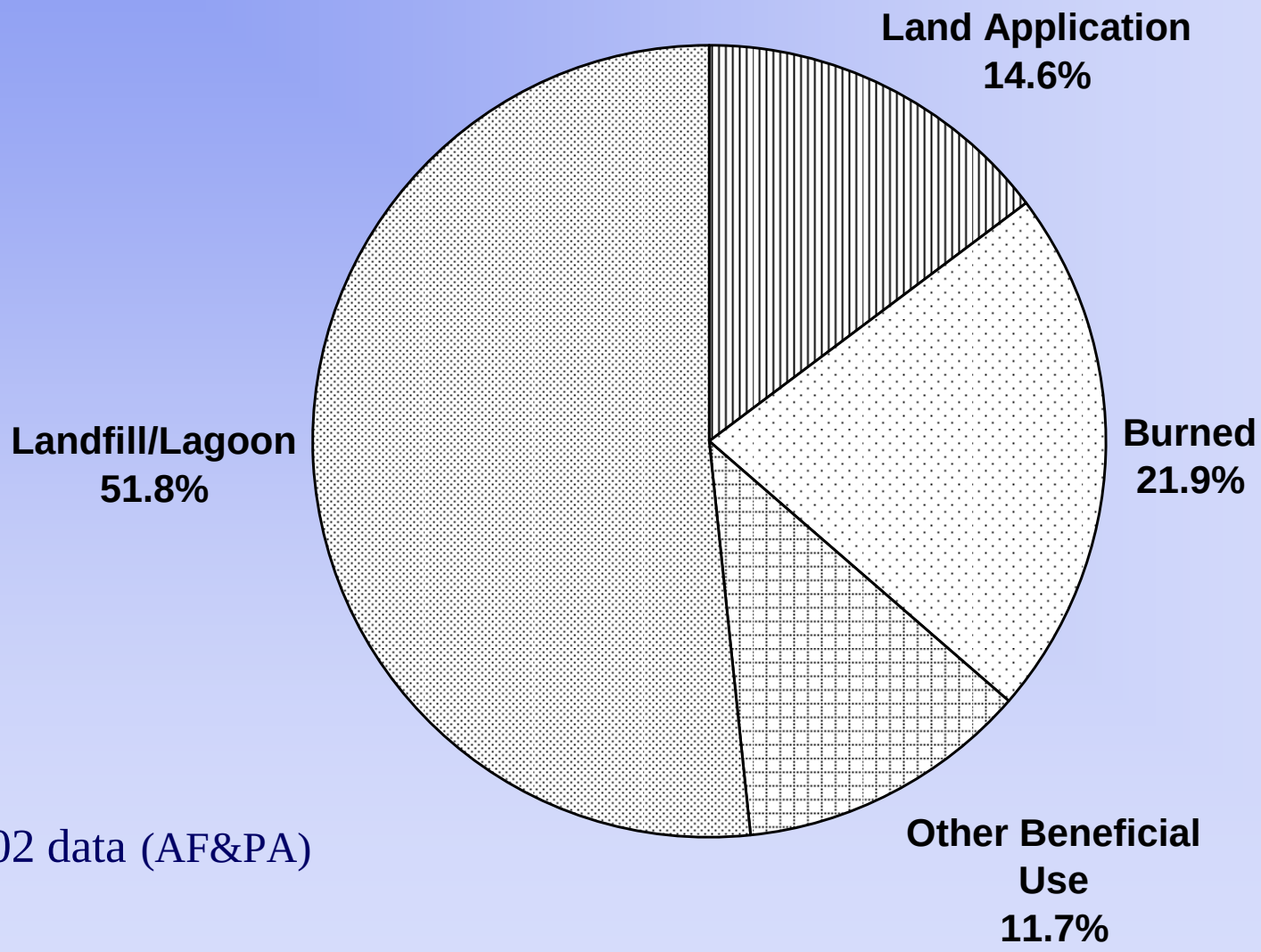
- **Small number of mills dry residuals (70-95% solids)**

Characteristics of WWTP Residuals

- **Primary WWTP residuals consist mainly of**
  - **Wood fiber**
  - **Inorganic or mineral matter (e.g., clay, $CaCO_3$, TiO_2)**
- **"Ash" (inorganic) content of primary WWTP residuals ranges from <10% to >70% (dry wt. basis)**

- **Secondary WWTP residuals consist mostly of bacterial biomass (non-pathogenic)**

Management of WWTP Residuals



2002 data (AF&PA)

Management of WWTP Residuals

- **Land application**
  - **Utility: soil conditioner, fertilizer, liming agent, mulch**
  - **Potential issue: high C:N ratio**
    (quite high for primary residuals)

- **Burning (usually onsite)**
  - **Utility: energy, volume reduction**
  - **Potential issues: high moisture**
    high "ash"

Other Uses for WWTP Residuals

- Papermaking fiber/filler
- Industrial absorbent
- Animal bedding/litter
- Manufactured soil component
- Compost feedstock
- Landfill barrier cover
- AMD* control cover
- Building board/fixture
- Brick or concrete additive
- Glass or lightweight aggregate
- Cement kiln feedstock
- Fuel pellet ingredient

* Acid mine drainage

WWTP Residuals Case Study

- Startup company in the Northwest began manufacturing residuals-based products for consumer, agricultural, and industrial markets in 1986
- Technical and marketing challenges resulted in 12 years of effort before first profit realized
- Major products currently are
  - Small-animal bedding
  - Cat litter
  - Oil-spill & general industrial absorbents

WWTP Residuals Case Study

- **Products available in 16 countries**
- **Bedding & litter available in major U.S. pet store and department store chains**
- **Recently built a 2nd manufacturing plant in the Southeast to better serve Eastern U.S. and began product shipments in December 2004**

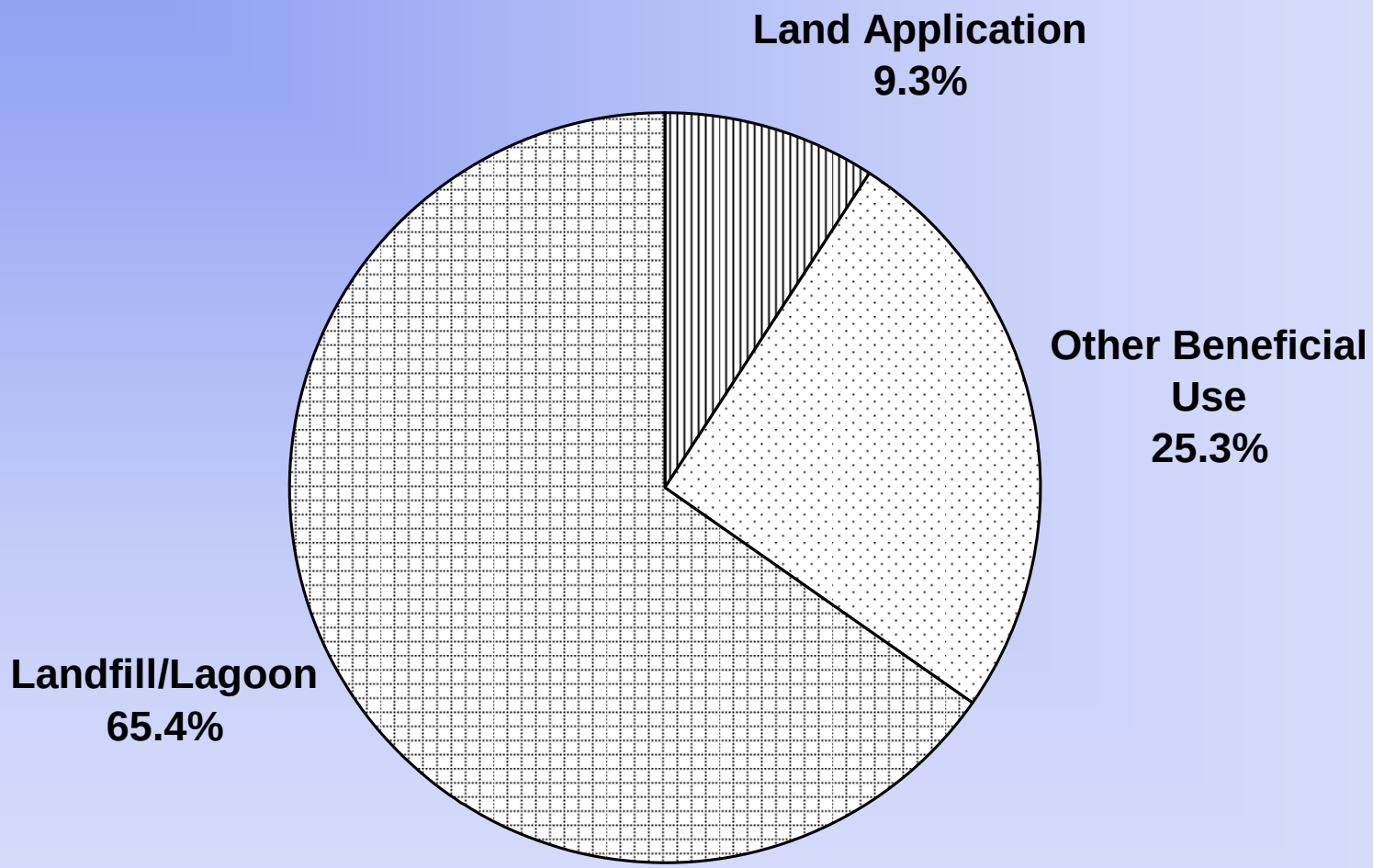
Boiler Ash

- **4 million dry tons annually**

- **Types (based on fuel)**
  - **Wood**
  - **Coal**
  - **Wood and coal**
  - **Wood, coal, or both with miscellaneous solid fuels**

- **Wood ash**
  - **High in unburned carbon (char)**
  - **High in Ca, source of K and P**
  - **Alkaline**
  - **Cementitious**

Management of Boiler Ash



2002 data (AF&PA)

Management of Boiler Ash

- **Land application**
  - **Utility: liming agent, fertilizer**
  - **Potential issue: unburned carbon (wood ash)**

Other Uses for Boiler Ash

- Compost feedstock
- Manufactured soil component
- Cement kiln feedstock
- Concrete additive
- Flowable fill (CLSM)*
- Waste stabilization
- Soil stabilization
- Earthen construction
- Asphalt aggregate
- Landfill daily cover

* CLSM = controlled low-strength material

Boiler Ash Case Study

- Southeastern mill had its coal fly ash used as concrete ingredient for highway & other applications
- State DEP approved injecting wood ash into coal boiler (to obtain more energy and lower ash loss-on-ignition)
- State DOT approved use of coal-wood fly ash in concrete after short-term and long-term (>3 yrs) testing
- With coal-wood fly ash added, concrete is
  - Stronger and more durable
  - More resistant to water erosion (saltwater use)
  - Less expensive

- Coal-wood bottom ash employed as aggregate in asphalt mixes and in concrete blocks

Summary

- **Two significant byproducts from the paper industry are WWTP residuals and boiler ash**
- **Land application is an important beneficial use for both types of materials**
- **There are numerous examples of other uses**
- **Paper companies continue to seek beneficial use opportunities and increasingly explore novel uses**

Questions & Comments

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